

**Appendix J: FY14 TCHD Off-Post Groundwater
Monitoring Report**



Tri-County Health Department Memorandum
4201 East 72nd Avenue, Suite D
Commerce City, Colorado 80022-1488
Phone: (303) 288-6816 Fax: (303) 439-5996

To: Roberta Ober, RMA Committee Coordinator

From: Deanne Kelly, TCHD RMA Program

Date: March 26, 2015

Subject: FY2014 Results for Off-Post Private Well Sampling Program

cc: Greg Hargreaves, Environmental Protection Agency (EPA)
Susan Newton, Colorado Department of Public Health and
Environment (CDPHE)
Dorthea Hoyt, Pacific Western Technologies, Inc.
Trevor Klotz, Sentinel Consulting Services, Inc.
Army/Shell Water Team.

In accordance with the Memorandum of Agreement (MOA) Between Tri-County Health Department and Program Manager for the Rocky Mountain Arsenal (PMRMA), Article III., Item 1, Tri-County Health Department (TCHD) shall coordinate the Off-Post Private Well Sampling Program, assist in the Off-Post Groundwater Exceedance Monitoring Program, and report the results of the monitoring program to the PMRMA on an annual basis. Pursuant to this requirement, TCHD is submitting this memorandum summarizing the monitoring results for Fiscal Year (FY) 2014.

Included in this memorandum is a summary discussion of the FY2014 sampling results as supported by the following enclosures: 1) Table 1.0 –DIMP Sampling Results for FY2014 Candidate Sampling List; 2) Figure 1.0 – Map of DIMP Sampling Results for FY2014 Off-Post Private Well Sampling Program and Select 2012 CSRG Exceedance Areas; 3) Table 2.0 – 1,4-dioxane Sampling Results for FY2014; and 4) Figure 2.0 – Map of 1,4-dioxane Sampling Results for FY2014 Off-Post Private Well Sampling Program and Select 2012 CSRG Exceedance Areas.

The wells and surface water samples on the Candidate Sampling List were selected in concert with Army/Shell, EPA, CDPHE, and sampled for diisopropylmethyl phosphonate (DIMP) as in previous years to continue monitoring of this contaminant in the TCHD off-

post study area. In FY2012, the Remediation Venture Office (RVO) (since replaced by Army/Shell in 2013) and Regulatory Agencies agreed to sample and analyze the Candidate Sampling List for 1,4-dioxane as a result of EPA's recognition of this contaminant as an emerging contaminant and promulgation by the State of Colorado (State) of a cleanup standard for groundwater and surface water. The monitoring for 1,4-dioxane from the Candidate Sampling List samples in the off-post study area was also conducted in FY2014. Also consistent with the objective of previous year's off-post monitoring, surface water and monitoring well samples were collected from the surface impoundments used by Denver Water for water storage to verify that discharges to the South Platte River do not contain DIMP above the State standard for groundwater and surface water of 8.0 ppb.

In developing the FY2014 Candidate Sampling List, TCHD followed the same procedure as implemented in previous years. According to this procedure, a proposed FY2014 Candidate Sampling List was developed by TCHD and provided to Army/Shell and other Regulatory Agencies for concurrence. Comments on this proposed list were received from Army/Shell at the same time that concurrence without comment was received from the other Regulatory Agencies. TCHD incorporated the Army/Shell comments. Through the process, TCHD gained concurrence from Army/Shell on its FY2014 Candidate Sampling List as proposed, with a later addition of well 986B which was tested for DIMP but not 1,4-dioxane.

The original FY2014 Candidate Sampling List proposed by TCHD included twenty-four (24) wells and surface water sample locations. TCHD agreed to delete well I.D. No.914B, 1070B, 1171A and one (1) well I.D. 986B was added during the course of the sampling season. This brought the number of wells and surface water locations of the final FY2014 Candidate Sampling List to a total of twenty-five (25).

Of the original twenty-four (24) samples targeted by the Candidate Sampling List, (8) of the sample locations on the final FY2014 Candidate Sampling List could not be sampled in FY2014 for reasons that included: the inability to contact the owner for permission; inoperable well pump(s); closure/abandonment of wells; abandonment of property.

1,4-dioxane was a target analyte for the Off-Post Private Well Sampling Program for only the third year in FY2014. Consequently, all of the wells and surface water samples on the Candidate Sampling List that were sampled for DIMP were also sampled for 1,4-dioxane in FY2014, with the exception of well 986B which was a later addition to the Candidate Sampling List.

In addition to the analysis for DIMP and 1,4-dioxane, the samples were analyzed for the routine inorganic analytes of nitrate and fluoride, and water quality parameters of conductivity and hardness. The monitoring for these analytes and water quality parameters dates to the inception of the sampling program and serves to satisfy the objectives of: 1) fingerprint identification of the aquifer that is the source of the

groundwater; 2) detection of potential cross-contamination between aquifers; and 3) to satisfy the property owner's request for water quality data regarding their groundwater. Sampling of the FY2014 Candidate Sampling List was conducted by TCHD and analytical results are presented in the attached Table 1.0, Figure 1.0, Table 2 Figure 2.0 and summarized in the following sections according to DIMP and 1,4-dioxane.

DIMP

Analytical results for DIMP are summarized in the following table and segregated according to the specific ranges of: 1) concentrations greater than 8.0 ppb, the current State standard for groundwater and surface water; 2) concentrations between 0.5 ppb, the method reporting limit (MRL) and 8.0 ppb, and 3) concentrations less than the MRL of 0.5 ppb.

Table 1.0

	<u>DIMP Concentration (ppb)</u>			<u>Total</u>
	<u>> 8.0</u>	<u>0.50-8.0</u>	<u>< 0.50</u>	
Alluvial Wells	0	8	3	11
Confined Wells	0	1	3	4
Total Well Samples	0	9	6	15
Surface Water Samples	0	1	1	2
Total Samples	0	10	7	17

Discussion of Alluvial and Confined System Sampling Results

As indicated in the above table, a total of fifteen (15) alluvial and confined system wells were sampled for DIMP and trending of these results as well as comparison with previous year's results are summarized as follows.

In 2014, the detection of DIMP in the alluvial and confined wells ranged in concentration from 1.24 to 7.32 ppb and DIMP was not detected in three (3) of the alluvial wells that were sampled. An area of potential concern is the confined well 359A belonging to a Mr. Durham at 10850 Brighton Road. On May 31, 2011, DIMP was sampled and analysed from this well at a level of 10.50 ppb. Due to this exceedance and the fact this well is used for domestic purposes, the well was resampled on June 16, 2011 with a DIMP result of <0.5 ppb. On July 23, 2013 the well was sampled and yielded a DIMP result of 2.02 ppb. The 2014 samples had an initial result of 7.32 ppb with a follow up confirmation sample of 7.07 ppb. These results represented an increase from DIMP detections obtained during FY2013 of 2.02 and a decrease from 10.05 in 2011. This well has had a variable use history since the residence was vacant for a period of time

due to a death and subsequent resale of the property. TCHD believes this situation could indicate the deep well may be located near the edge of a confined DIMP plume.

For alluvial wells that were sampled in FY2014, there was an increase in concentration from 2013 to 2014 for five (5) wells (I.D. Nos. 494C, 359C, 985B, 992A, and 541A). These increases in concentration, from 4.06 in 2013 to 4.67 in 2014, from 1.04 in 2013 to 1.28 in 2014, from 1.54 in 2013 to 3.19 in 2014, from 0.75 in 2013 to 1.24 in 2014 and, 1.22 in 2013 to 2.18 in 2014 respectively. Three (3) wells (993A, 986A, and 1190B) showed a decrease in DIMP concentration when compared with the results obtained during the last sampling of the wells in, FY2012, and FY2013. Finally, four (4) wells (550A, 843A, 986B and 1324C) whose last sampling indicated no detection of DIMP continued to have no detection of DIMP in FY2014.

Two (2) of the alluvial wells were sampled for the first time in FY2014 and included: well I.D. No. 1334H belonging to Mr. John Durham located at 10901 Brighton Road, Henderson, CO. and Well I.D. No 569A belonging to Mr. Dunn located at 12121 Oakland St., Henderson, CO. Mr. Dunn contacted TCHD at the end of the 2013 season and requested the sampling of his well. Well 569A was sampled once for DIMP in 1994. Since 1994, Well 569A had only been sampled for routine analysis.

Discussion of Denver Water Sampling Results

Two (2) surface water sample locations belonging to Denver Water were sampled in FY2014 to verify that discharges to the South Platte River do not contain DIMP above the State standard for groundwater and surface water of 8.0 ppb.

The first surface water sample, I.D. No. 547-S3, was located at 11201 Brighton Road and represents the combined flow of Bull Run and First Creek into the South Platte River. The result for this surface water sample produced a non-detect DIMP concentration that represents a slight decrease in concentration from the value of 0.60 ppb obtained in FY2013. The second surface water sample, I.D. No. 555-S1, was collected from a discharge pipe located near 120th Parkway and the South Platte River and represents water that discharges to the South Platte River from the dewatering trenches. DIMP was detected at this second surface water sample at 1.20 ppb of which represents a slight decrease in concentration from the value of 1.59 ppb detected in FY2013. Both of these surface water samples were grab samples and therefore considered non-standard.

The discharges to the South Platte River from the Denver Water storage impoundments continue to show detections below the State standard for groundwater and surface water of 8.0 ppb.

1,4-dioxane

Analytical results for 1,4-dioxane are summarized in the following table and segregated according to the ranges of values that allow for comparison with the current and

previous State standards for groundwater and surface water. Until January 31, 2013, the State 1,4-dioxane standard for groundwater and surface water was 3.2 ppb. On January 31, 2013, the State standard for groundwater and surface water was lowered to 0.35 ppb. As presented in Table 2.0, the 1,4-dioxane results are segregated according to the specific ranges of: 1) concentrations greater than 0.35 ppb, the current State standard for groundwater and surface water; 2) concentrations between the MRL of 0.1 ppb and less than 0.35 ppb; and 3) concentrations less than the MRL of 0.1 ppb.

Table 2.0

	<u>1,4-dioxane Concentration (ppb)</u>			<u>Total</u>
	<u>>0.35</u>	<u>0.1 - 0.35</u>	<u>< 0.1</u>	
Alluvial Wells	1	9	1	11
Confined Wells	0	0	3	3
Total Well Samples	1	9	4	14
Surface Water Samples	0	1	1	2
Total Samples	1	10	5	16

A total of ten (10) wells and surface water samples had detections below the current State standard for groundwater and surface water of 0.35 ppb and five (5) wells and surface water samples were non-detect. Finally, 1,4-dioxane was detected above the state standard in one (1) of the alluvial wells (well 550A) at a level of 0.54 ppb. As stated previously, confined well 986B was analyzed for DIMP but not 1,4-dioxane.

As previously discussed, 1,4-dioxane has only been sampled in FY2012, FY2013 and 2014 so trending of this analyte in the study area would not be meaningful. However, of the alluvial and confined system wells that were sampled in both FY2013 - FY2014, seven (7) exhibited slight decreases in concentration while two (2) exhibited slight increases in concentration. Results for the three (3) confined wells sampled in 2014 and the (5) confined wells in 2013 were non-detect.

Since 1,4-dioxane is regulated as a groundwater and surface water contaminant in the State of Colorado and represents a contaminant of interest to the EPA, TCHD will continue to recommend the sampling and analysis for this compound in future off-post groundwater monitoring efforts.

Summary

A total of twenty-four (24) wells were approved for sampling in the original FY2014 Candidate Sampling List. There were eighteen (18) alluvial wells, four (4) confined system wells and two (2) surface water samples. Well ID No. 986B, a confined well, was subsequently added to the CSL due to a request by the owner and was only sampled for DIMP. This brought the total approved wells to twenty-five (25). Of these sample locations, TCHD was able to sample eleven (11) alluvial wells, four (4) confined system wells and two (2) surface water locations.

DIMP detections in the wells and surface water samples ranged from 1.24 to 7.32 ppb which were all below the State standard of 8.0 ppb for groundwater and surface water.

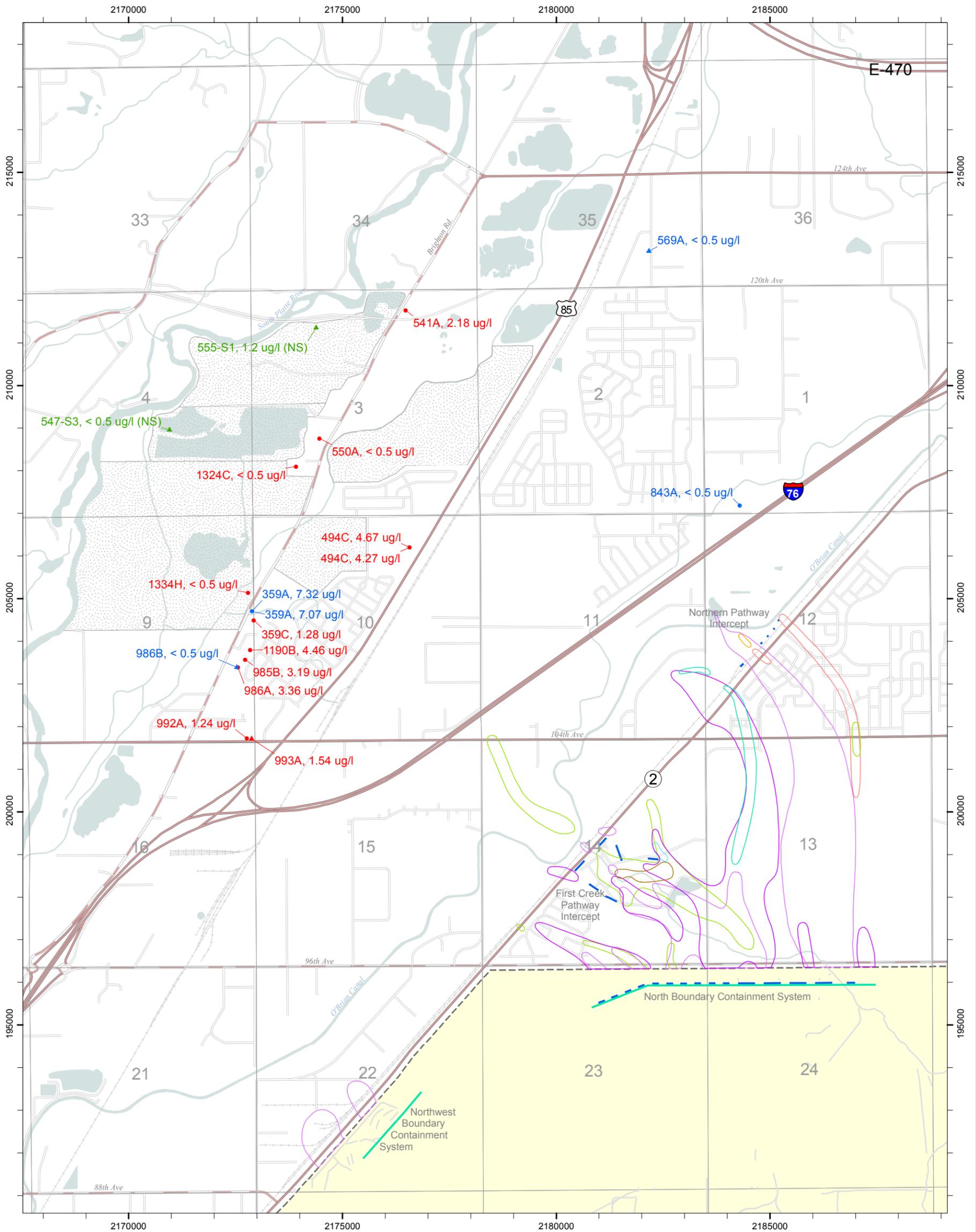
The 1,4-dioxane results indicated only one (1) alluvial well at 0.54 ppb that had a detection above the current State standard for groundwater and surface water of 0.35 ppb.

TCHD recommends sampling of well 359A during the winter with the expectation that it would be non-detect based on reduced seasonal use.

Well ID No.	Last Sample Date	Last DIMP Conc (ppb)	2014 DIMP Conc (ppb)	2013 1,4DIOX Conc (ppb)	2014 1,4DIOX Conc (ppb)	2014 Sample Date	Property Owner	Well Location	Aquifer/Flow System	Comments
843B	6/26/2012	1.09 (NS)	NA	0.19 (NS)	NA	NA	Rodriguez	12381 E. 112th Ave.	Alluvial	Shallow irrigation well in northern pathway and end of historical carbon tetrachloride plume. Well not working according to owner, unable to access 2014.
993A	5/18/2010	2.07	1.54	NPS	0.23	7/16/2014	Seader	8861 East 104th	Alluvial	
494B	6/24/2013	2.47 (NS)	NA	0.13 (NS)	NA	NA	Yelenick	9940 E. 112th Ave.	Alluvial	Non-standard sample. Wind mill well. Unable to access 2014.
494C	6/24/2013	4.06 (NS)	4.67 4.27 (DUP)	0.21 (NS)	0.15 0.14 (DUP)	08/12/2014	Yelenick	9940 E. 112th Ave.	Alluvial	Well has consistent DIMP detections.
1334H	NPS	NPS	LT 0.5	NPS	LT 0.1	06/26/2014	Durham	10901 Brighton Rd.	Alluvial	Owner requested well to be sampled. New well never sampled. Former Mobile Premix property.
359C	7/23/2013	1.04	1.28	0.16	0.16	6/26/2014	Durham	10850 Brighton Rd.	Alluvial	Owner requested well to be sampled. Shallow irrigation well with gas powered pump at former Heckert house that refused hook-up to SACWSD.
986A	6/13/2012	6.59 6.85 (DUP)	3.36	0.26 0.26 (DUP)	0.21	8/20/2014	Thomas	10720 Brighton Rd.	Alluvial	Historical DIMP detections.
1190B	6/30/2013	4.87	4.46	0.18	0.12	06/30/2014	Barclay	10760 Brighton Rd.	Alluvial	Historical DIMP detections.
984B	5/25/2010	2.62	NA	NPS	NA	NA	Ibarra	10740 Brighton Rd.	Alluvial	Owner requested well to be sampled. Historical DIMP detections last sampled in 2010. Well not functional as of 07/07/14, unable to access.
985B	8/1/2013	1.54 (NS)	3.19	0.16 (NS)	0.11	08/20/2014	Pryor	10730 Brighton Rd.	Alluvial	Historical DIMP detections.
992A	7/8/2013	0.75	1.24	0.19	0.22	07/22/2014	Rowe	8821 E. 104th Ave.	Alluvial	Historical DIMP detections.
538A	6/27/2012	LT 0.5 LT 0.5(DUP)	NA	0.42 0.43(DUP)	NA	NA	Acklam	10280 E. 128th Ave.	Alluvial	Detection of 1,4-dioxane in 2012 above State cleanup standard. Unable to contact owner 2014.
550A	7/9/2013	LT 0.5	LT0.5	0.73	0.54	6/25/2014	Sweetman	11481 Brighton Rd.	Alluvial	Shallow well for water supply in commercial building. Location in Section 3 in path of historical DIMP plume. Detection of 1,4-dioxane in 2013 above State cleanup standard.
1185B	5/29/2013	0.85	NA	0.17	NA	NA	Green Acres	10801 Havana St.	Alluvial	Shallow irrigation well for former turf farm located in path of historical DIMP plume. Needs sample pump. Unable to access well 2014.
1185C	6/6/2013	1.2	NA	0.16	NA	NA	Green Acres	10801 Havana St.	Alluvial	Irrigation well for former turf farm. Location in Section 10 in path of historical DIMP plume. Needs sample pump. Unable to access well 2014.
1324C	6/27/2013	LT 0.5	LT 0.5	0.19	0.19	07/15/2014	Doerksen	11299 Brighton Rd.	Alluvial	2011 DIMP detection 3.18
339B	6/21/1993	2.21	NA	NPS	NA	NA	Kim	11351 E. 112th Ave.	Alluvial	Attempted contact in 2013 but found that owner had passed away. House is abandoned. New owner contacted by phone 2014 but no response and house still abandoned. Unable to access 2014.
541A	7/9/2013	1.22	2.18	0.16	0.29	07/21/2014	Sweetman	11920 Brighton Road	Alluvial	
Alluvial Aquifer Subtotal									18	

Well ID No.	Last Sample Date	Last DIMP Conc (ppb)	2014 DIMP Conc (ppb)	2013 1,4DIOX Conc (ppb)	2014 1,4DIOX Conc (ppb)	2014 Sample Date	Property Owner	Well Location	Aquifer/Flow System	Comments
984A	9/6/1997	2.21	NA	NPS	NA	NA	Ibarra	10740 Brighton Rd.	Confined	Owner requested well to be sampled. Use of well for residential purposes. Unable to access in 2012. Well has been disconnected. Connected to SACWSD as of 02/24/99. Unable to access 2014.
843A	6/25/2012	LT 0.5 LT 0.5 (DUP)	LT 0.5	NPS	LT 0.1	07/02/2014	Rodriguez	12381 E. 112th Ave.	Confined	Residential well water use inside house. No connection to South Adams County Water and Sanitation District.
359A	7/23/2013	2.02	7.32 7.07 (CS)	LT 0.1	LT0.1 LT 0.1 (CS)	6/26/2014	Durham	10850 Brighton Rd.	Confined	Arapahoe well with high DIMP detection (10.5 ug/l) in 2011. Property Across street from Mr. Durham's house.
569A	NPS	NPS	LT 0.5	NPS	LT 0.1	7/7/2014	Dunn	12121 Oakland St	Confined	Requested sampling at end of 2013 season. Well last tested for DIMP in 1994 with no detections. Only routine sampling and analysis has been performed since.
986B	5/18/2009	LT 0.5	LT 0.5	NPS	NA	8/20/2014	Thomas	10720 Brighton Rd.	Confined	Owner requested sampling. Did not test for 1,4-dioxane.
Confined Aquifer Subtotal									5	
547-S3	7/16/2013	0.6 (NS)	LT 0.5 (NS)	0.29 (NS)	0.16 (NS)	9/15/2014	Denver Water	11201 Brighton Rd.	Surface	Surface water sample of Bull Run and First Creek discharge to South Platte River. Detection of 1,4-dioxane in 2012 above State cleanup standard.
555-S1	7/16/2013	1.59 (NS)	1.20 (NS)	0.11 (NS)	LT 0.1 (NS)	9/15/2014	Denver Water	120th Ave. and South Platte River	Surface	Surface water sample of discharge from dewatering trenches to South Platte River.
Surface Subtotal									2	
Total Samples									25	

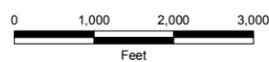
NA denotes unable to access
(NS) denotes a non-standard grab sample.
(NPS) denotes no previous sample
(CS) denotes confirming sample



Map of DIMP Sampling Results for FY2014 Off-Post Private Well Sampling Program and Select 2012 Exceedance Areas

Legend

- | | |
|---|--|
| <ul style="list-style-type: none"> — Recharge Trenches — Slurry Walls ● Alluvial Well ▲ Alluvial Well (Approx. Loc.) ● Arapahoe Well ▲ Arapahoe Well (Approx. Loc.) ▲ Surface Water Sample Point (Approx. Loc.) Rocky Mountain Arsenal (NS) Non-Standard Sample | <ul style="list-style-type: none"> Gravel Pits Lake, Pond, River, Canal, Stream 1,2-Dichloroethane (12DCLE) Plume Arsenic (AS) Plume Carbon tetrachloride (CCL4) Plume Dicyclopentadiene (DCPD) Plume Diisopropylmethylphosphonate (DIMP) Plume Dieldrin (DLDRN) Plume Fluoride (F) Plume Tetrachloroethylene (TCLEE) Plume |
|---|--|



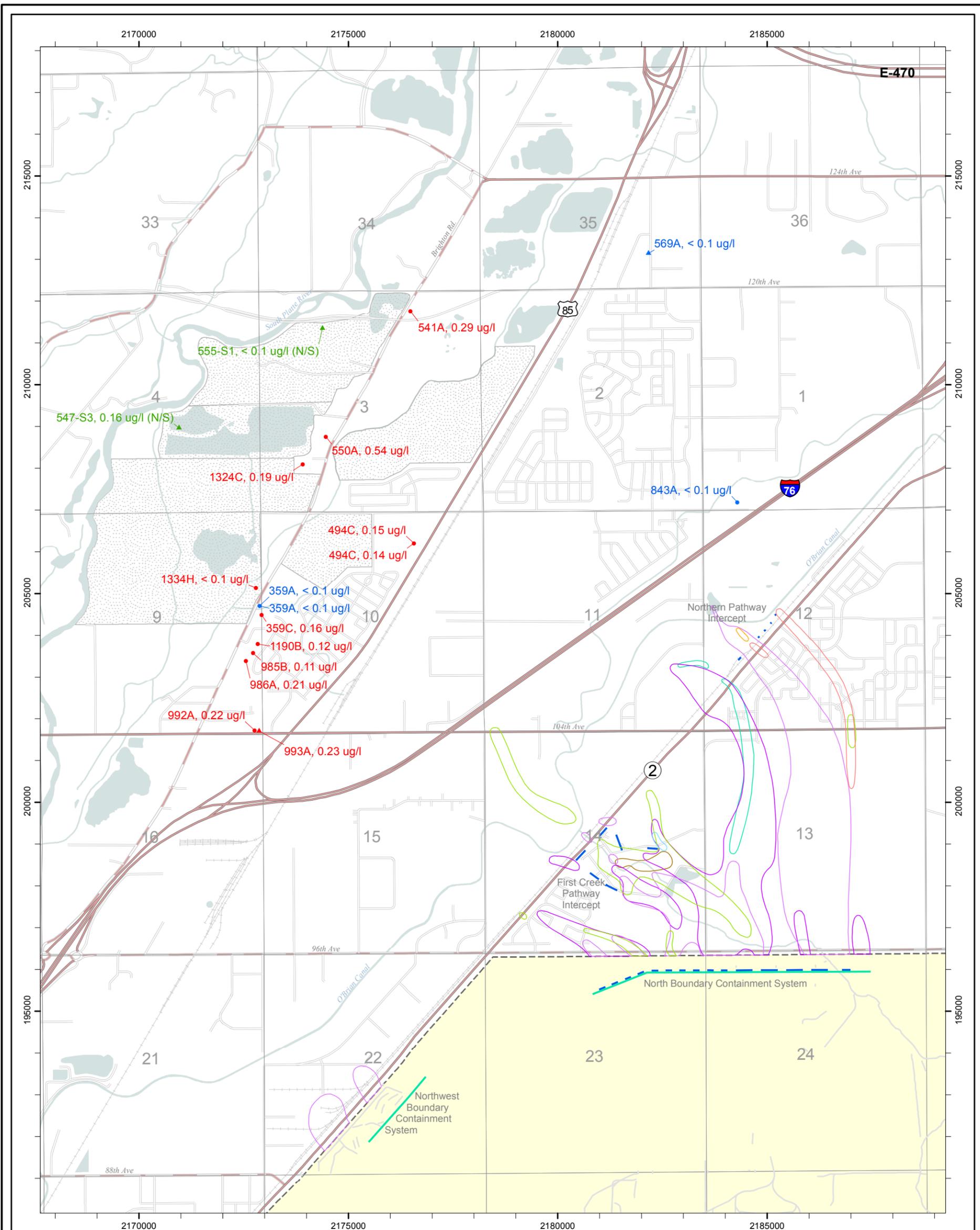
NAD27-NGVD29 Datum, US Survey Feet, Colorado North Zone
Sources: U.S. Army, RMA GIS, PMC/OMC, Shell/URS Corp. & TCHD

Figure 1.0

Army/Shell GIS

9/25/2015 RMITS

Prepared for: TCHD



Map of 1,4-Dioxane Sampling Results for FY2014 Off-Post Private Well Sampling Program and Select 2012 Exceedance Areas

Legend

- | | |
|---|---|
| <ul style="list-style-type: none"> — Recharge Trenches — Slurry Walls ● Alluvial Well ▲ Alluvial Well (Approx. Loc.) ● Arapahoe Well ▲ Arapahoe Well (Approx. Loc.) ▲ Surface Water Sample Point (Approx. Loc.) Rocky Mountain Arsenal (NS) Non-Standard Sample | <ul style="list-style-type: none"> Gravel Pits Lake, Pond, River, Canal, Stream 1,2-Dichloroethane (12DCLE) Plume Arsenic (AS) Plume Carbon tetrachloride (CCL4) Plume Dicyclopentadiene (DCPD) Plume Diisopropylmethylphosphonate (DIMP) Plume Dieldrin (DLDRN) Plume Fluoride (F) Plume Tetrachloroethylene (TCLEE) Plume |
|---|---|



0 1,000 2,000 3,000
Feet

NAD27-NGVD29 Datum, US Survey Feet, Colorado North Zone
Sources: U.S. Army, RMA GIS, PMC/OMC, Shell/URS Corp. & TCHD

Figure 2.0

Army/Shell GIS

8/27/2015 RMITS

Prepared for: TCHD